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Complexing Agents
to
Dextrose and Starch Syrups

needs of the Israeli textile industry. Small amounts of Egyptian-type cotton, particularly American Pima type, are also grown.

The annual Thailand crop is generally about 60,000 bales, partly meeting an internal consumption of 90,000 bales. Much of the cotton is composed of short, coarse, Asiatic types, but some consists of Cambodian varieties of American Upland. This latter cotton is predominantly of about $\frac{7}{8}$-in. staple, but more recently developed longer strains are grown in small quantities.

Iraq production fluctuates about a level of 30,000 bales and is roughly equal to the consumption of the country's textile industry. Much of the crop is of about $\frac{1}{32}$-in. staple and is raised from seed of the Coker 100 Wilt and earlier Acala introductions.

The Korean crop fell to 25,000 bales in 1962/1963 with a further decline expected for the following season. It consists mainly of American Upland types and is but small compared with the annual consumption of 300,000 bales inside the country. Prior to 1939 the crop exceeded 200,000 bales a year.

Aden or South Arabia is the most important producer in Asia of Egyptian-type cotton. The crop of about 30,000 bales is grown from seed of the Sudan Lambert variety. The cotton is favored by spinners in several countries for the manufacture of nep-free yarns in moderately fine counts. Other Asian cotton-growing countries, and also Australia, grow but small crops, rarely exceeding 15,000 bales in a good season and usually falling appreciably short of this level.

Physical Properties

Morphological Structure. Shortly before the opening of a flower, some of the epidermal cells of the small ovules or young seeds commence to develop and elongation of them continues if fertilization occurs subsequently. This first phase of development of the sprouting epidermal cells commonly lasts for a period of 2.5–3.5 weeks, depending upon both variety of seed and environment of the plant. During tihs elongation process the living contents of the cell are enclosed within a primary wall composed partly of cellulose and partly of other substances some of which are of a pectic nature. This primary cellulose is in the form of fine fibrils which spiral at an angle to the length axis of the cell. There is a surface deposit or cuticle of fats, waxes, and resins on the primary wall; this complex of primary wall and cuticle is thin, of the order of 0.2 μ, compared with a value of the order of 20 μ for the cell diameter. After the cell has become transformed into a young hollow fiber which has attained its final length, a second phase of growth starts and continues for 5–8 weeks more, according to variety and environment. The wall of the fiber increases in thickness until only a few days before the bursting open of the boll containing the seeds. This increase in the secondary wall of the fiber consists mainly of cellulose, and eventually constitutes most of the weight of the fully grown fiber.

The wall of the fiber is built up in the form of concentric layers of fibrils, each in a spiral pattern. The first layer deposited on the interior of the primary wall is termed the winding; subsequent layers are formed daily and consist of a dense deposit made during the daytime, and a more porous part formed during the night. The spirals in the secondary wall, unlike those in the primary wall, usually make frequent changes in direction of rotation at intervals along the length of the fiber. Even at the cessation of secondary wall increment the interior of the cell is not wholly filled; there is a lumen or central canal extending along the axis of the fiber and containing the cell nucleus and protoplasm. When the boll bursts, the contents of the lumen dry into a small residue and the fiber wall loses moisture. There is a greater shrinkage perpendicular to the structural fibrils than parallel to them. This causes collapse of the fiber wall and a twisting of the fiber about its axis to an extent dependent upon the wall thickness and cell perimeter. Convolutions or twists appear with reversal of direction at irregular intervals along the length of the fiber. Their pattern depends upon the pattern of the spiral structure of the secondary wall and their prominence on the fiber wall thickness and perimeter. In cottons of average secondary wall development there are usually about 60 convolutions/cm of fiber length; the frequency is smaller in cottons with a secondary wall thickening that is either appreciably thinner or thicker than average. Fiber wall thickness and convolution frequency vary appreciably from one fiber to another, even on the same seed (see Fig. 3).

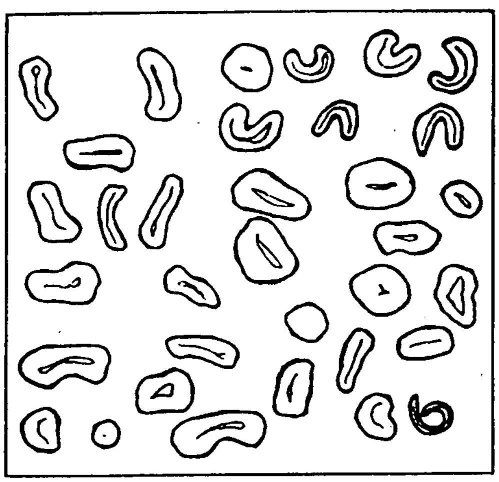

Fig. 3. Drawing of cross sections ($\times$ 250) of mature American Upland cotton.

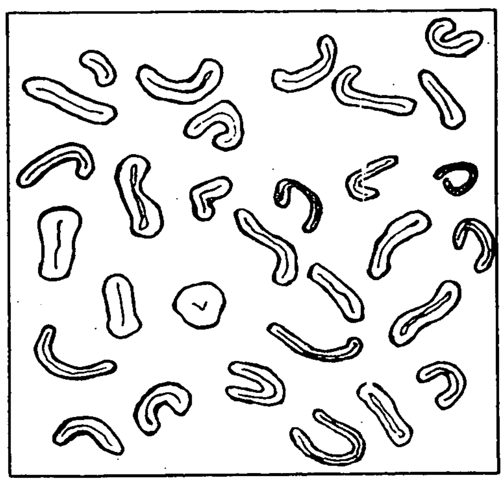

Fig. 4). Drawing of cross sections ($\times$ 250) of immature American Upland cotton.

Various conditions of growth may lead to a lower than normal development of the secondary wall thickening (see Fig. 4). A fiber with a thin secondary wall is termed immature although it may have developed within the boll for about the normal period of time, but at a slower rate. An extreme form of immature fiber arises when there is little or no secondary wall thickening established because of exceptionally unfavorable growth conditions or premature termination of seed or boll growth following attack by disease or pest. When such fibers collapse and dry at boll split, the very thin wall results in an absence of convolutions; the fibers have a flat ribbon-like form and a low rigidity. Such cotton is termed "dead cotton"; it has a "dead" or flat appearance because it is lacking in luster, and feels "dead" because it has not the spring feel characteristic of well-matured cotton.

Dimensions and Shape. The complex shape and structure of the cotton fiber gives rise to a range of dimensional and shape features. Many features differ markedly from one fiber to another and, for most purposes, it is necessary to consider values which represent sample averages, or which typify some particular aspect of the complete frequency distribution of a feature.